STARTERS-p.367 33-37 all NO Calculators

33 -9
34 -8
35 61
36 -4
37 30 B

5

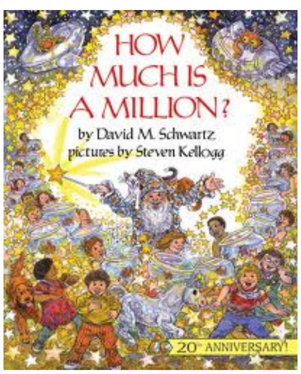
Chapter 9 Exponents & Scientific Notation

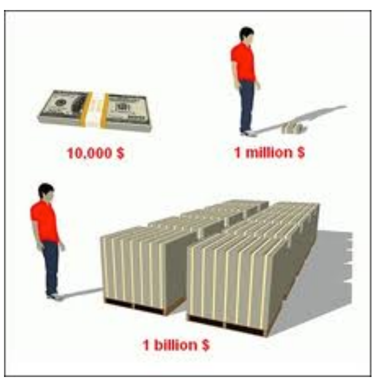
9.3 Quotient of Powers Property

Unit Question: What is the power of powers?

Learner Profile: Reflective

Area of Interaction: Community & Service





I Can Statement:

I can divide powers with the same base.

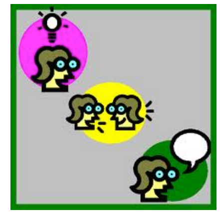
1 ACTIVITY: Finding Quotients of Powers

Work with a partner. Journal page 183

a. Copy and complete the table.

Quotient	Repeated Multiplication Form	Power
$\frac{2^4}{2^2}$	$\frac{\cancel{2}\cdot\cancel{2}\cdot 2\cdot 2}{\cancel{2}\cdot\cancel{2}}$	2^2
$\frac{(-4)^5}{(-4)^2}$	$\frac{\cancel{(-4)}\cdot\cancel{(-4)}\cdot(-4)\cdot(-4)\cdot(-4)}{\cancel{(-4)}\cdot\cancel{(-4)}}$	$(-4)^3$
$\frac{7^7}{7^3}$	$\frac{\cancel{7}\cdot\cancel{7}\cdot\cancel{7}\cdot 7\cdot 7\cdot 7\cdot 7}{\cancel{7}\cdot\cancel{7}\cdot\cancel{7}}$	7^4
$\frac{8.5^9}{8.5^6}$	8.5^{9-6}	8.5^3
$\frac{10^8}{10^5}$	10^{8-5}	10^3
$\frac{3^{12}}{3^4}$	3^{12-4}	3^8
$\frac{(-5)^7}{(-5)^5}$	$(-5)^{7-5}$	$(-5)^2$
$\frac{11^4}{11^1}$	11^{4-1}	11^3

Think, Pair, Share



What is the rule for dividing two powers that have the same base?

Why does this rule work?

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b. **INDUCTIVE REASONING** Describe the pattern in the table. Then write a rule for dividing two powers that have the same base.

$$\frac{a^m}{a^n} = a^{\square}$$

c. Use your rule to simplify the quotients in the first column of the table above. Does your rule give the results in the third column?

Key Idea

Quotient of Powers Property

Words To divide powers with the same base, subtract their exponents.

Numbers $\frac{4^5}{4^2} = 4^{5-2} = 4^3$ **Algebra** $\frac{a^m}{a^n} = a^{m-n}$, where $a \neq 0$

Example Problems:

#1 $\frac{2^6}{2^4}$ $2^{6-4} = 2^2$

#2 $\frac{(-7)^9}{(-7)^3}$ $(-7)^{9-3} = (-7)^6$

#3 $\frac{x^7}{x^6}$ $x^{7-6} = x$

Your Turn. Turn to page 186 in your workbook.
Complete problems #1-6.

9.3 Practice

For use after Lesson 9.3

Simplify the expression. Write your answer as a power.

1. $\frac{7^6}{7^5}$ 1

7

2. $\frac{(-21)^{15}}{(-21)^9}$

$(-21)^6$

3. $\frac{8.6^{11}}{8.6^4}$

8.6^7

4. $\frac{(3.9)^{20}}{(3.9)^{10}}$

$(3.9)^{10}$

5. $\frac{t^7}{t^3}$

t^4

6. $\frac{d^{32}}{d^{16}}$

d^{16}

Example Problems: Simplify. Write you answer as a power.

#1 $\frac{2^4 \cdot 2^6}{2^4} = 2^6$

#2 $\frac{(-7)^8(-7)^2}{(-7)^3}$ $(-7)^7$.

a^{m-n}

#3 $\frac{x^4x^2}{x^6} = \frac{x^6}{x^6} = \cancel{X}$ $\cancel{x}$ x^0

x^{6-6}

Your Turn. Turn to page 186 in your journal. Complete problems #7-9.

7. $\dfrac{8^7 \bullet 8^4}{8^9} = 8^2$

8. $\dfrac{(-1.1)^{13} \bullet (-1.1)^{12}}{(-1.1)^{10} \bullet (-1.1)^{1}}$

$\dfrac{(-1.1)^{25}}{(-1.1)^{11}}$

$(-1.1)^{14}$

9. $\dfrac{m^{50}}{m^{22}} \bullet \dfrac{m^{17}}{m^{15}}$

m^{30}

Example Problems: Simplify. Write you answer as a power.

#1 $\dfrac{2^3 \cdot x^6}{2^4}$ $\dfrac{x^6}{2^1}$ $2^{-1} \cdot x^6$

#2 $\dfrac{x^8\, y^2}{x^3\, x^8\, y^2}$ $= \dfrac{y^0}{x^3}$ · OR · $\dfrac{1}{x^3}$ · OR · x^{-3}

#3 $\dfrac{2^4\, x^4\, y^2}{2^3 \cdot x^6\, x^6}$ $\dfrac{2y^2}{x^8}$

Your Turn. Turn to page 186 in your journal. Complete problems #10-12.

Simplify the expression.

10. $\dfrac{k \bullet 3^9}{3^5}$

11. $\dfrac{x^4 \bullet y^{10} \bullet 2^{11}}{y^8 \bullet 2^7}$

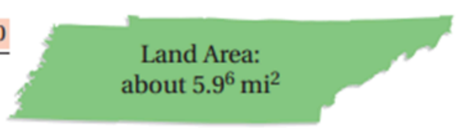
12. $\dfrac{a^{15}b^{19}}{a^6b^{12}}$

XAMPLE 4 Real-Life Application

The projected population of Tennessee in 2030 is about $5 \cdot 5.9^8$. Predict the average number of people per square mile in 2030.

Use a model to solve the problem.

$$\text{People per square mile} = \frac{\text{Population in 2030}}{\text{Land area}}$$



$$= \frac{5 \cdot 5.9^8}{5.9^6} \qquad \text{Substitute.}$$

$$= 5 \cdot \frac{5.9^8}{5.9^6} \qquad \text{Rewrite.}$$

$$= 5 \cdot 5.9^2 \qquad \text{Subtract the exponents.}$$

$$= 174.05 \qquad \text{Evaluate.}$$

There will be about 174 people per square mile in Tennessee in 2030.

I Can Statement:

I can divide powers with the same base.

Assignment:

Workbookp. 183
Textbook p.366-367
2-28 even